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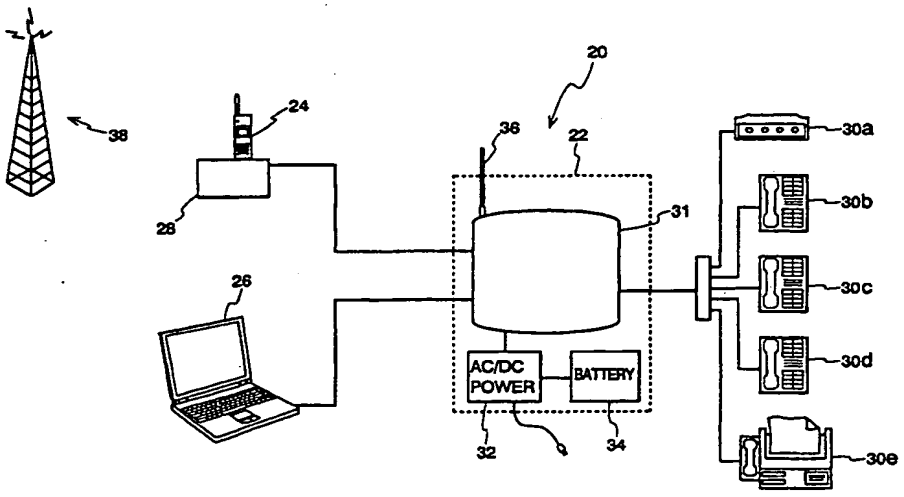

(57) Abstract

A system, and method of, using a radio transceiver within a fixed cellular terminal system as a component of a line interface system for communication from a DMTF unit, and also as a conventional portable cellular telephone is disclosed herein. The fixed cellular terminal system includes the line interface system, the radio transceiver, and a docking mechanism for connection of the radio transceiver to the line interface system. The line interface system includes a line interface controller and a power supply. The line interface controller is capable of providing a connection between a DTMF telecommunication unit and a cellular network. The radio transceiver connects the line interface system to a cellular network, and may also be used as a portable cellular telephone. The docking mechanism connects the radio transceiver to the line interface system in order to connect the line interface controller to the cellular network. The docking mechanism also allows for the radio transceiver to receive power from the power supply of the line interface system.

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A FIXED CELLULAR TERMINAL SYSTEM AND METHOD OF USING THE SAME

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to fixed cellular terminal systems. More specifically, the present invention relates to a system and method for allowing use of a cellular telephone in conjunction with a fixed cellular terminal system.

Description of the Related Art

In many locations in the world, people are forced to either do without or wait long periods for standard telephone service due to a lack of a wire telephone infrastructure. Such is the case in many remote locations, and in markets that cannot support or justify the investment in a wire telephone infrastructure. One solution to such a problem is a fixed cellular terminal system that provides standard telephone service by combining an analog telephone and a cellular communications device to provide telephone service over a cellular network.

A fixed cellular terminal system is available from the assignee herein. The system includes a single line module and a power supply with a battery backup unit. The system is intended to be installed in a consumer's home or office. The single line module includes a line interface controller and a radio transceiver. The line interface controller makes it possible to use multiple dual tone multi-frequency ("DTMF") telecommunication units at a single location. The DTMF telecommunication units may be telephones, facsimile machines, or modems. The DTMF units are connected to the line interface controller via the single line module using ordinary telephone jacks. The radio transceiver provides the interface to the cellular network. The radio transceiver is similar to a conventional cellular telephone, only it has modified software to perform the interface with the line interface controller. The interface to the cellular network conforms to cellular telephony standards, through normal operation of the radio transceiver. The system generates ringing, signal, dial, congestion, holler and any other needed tone to the DTMF units. The

line interface controller also converts tone into a serial data stream, and sends the data to the radio transceiver. The system may also include an echo canceler and metering functionality to support pay phone functionality.

However, one major limitation in a fixed cellular terminal system is the inability to use the radio transceiver as a conventional portable cellular telephone. Thus, if a consumer of the fixed cellular terminal system desired to also have a conventional portable cellular telephone, the consumer would need a separate subscription to the cellular telephone network.

BRIEF SUMMARY OF THE INVENTION

One aspect of the present invention is a fixed cellular terminal system for utilization of a DTMF telecommunication unit and a conventional portable cellular telephone in a cellular network. The system includes a line interface system, a radio transceiver and a docking mechanism. The line interface system includes a line interface controller. The line interface controller is capable of providing a connection between a DTMF telecommunication unit and a cellular network. The radio transceiver connects the line interface system to a cellular network, and may also be used as a conventional portable cellular telephone. The docking mechanism connects the radio transceiver to the line interface system.

The radio transceiver may be capable of detecting communications from the line interface controller to indicate the use of a DTMF telecommunication unit. The radio transceiver may also be capable of operating in a fixed mode for connection of a DTMF telecommunication network with a cellular network, and a portable mode for use as a conventional portable cellular telephone. The radio transceiver may also be capable of detecting if power is being supplied to the radio transceiver by the power supply of the line interface system. The fixed cellular terminal system may also be capable of switching between use of a DTMF telecommunication unit and the radio transceiver as a conventional cellular telephone

during a telephone conversation over the cellular network. The DTMF telecommunication unit may be selected from the group consisting of telephones, modems, and facsimile machines.

Another aspect of the present invention is a radio transceiver capable of utilization with a fixed cellular terminal system as a component of a line interface system of the fixed cellular terminal system and also as a stand alone conventional portable cellular telephone. The radio transceiver is capable of detecting communications from the line interface controller. The radio transceiver may provide connection to a cellular network for a DTMF telecommunication unit connected to the line interface system. The radio transceiver may also be capable of switching from a fixed mode to a portable mode during a conversation. The radio transceiver may function as one of a digital cellular telephone and an analog cellular telephone.

Another aspect of the present invention is a method of using the radio transceiver in a fixed cellular terminal system in a cellular network. The radio transceiver is operable in one of a fixed mode by interfacing with one of a modem, telephone, or facsimile machine through the radio transceiver to a cellular network and a portable mode as a conventional cellular telephone using the cellular network. The radio transceiver may be changed to the other of the fixed mode and the portable mode. The method may also include placing the radio transceiver in a conversation mode and changing the operation of the radio transceiver to the other of the fixed mode and the portable mode while maintaining the radio transceiver in the conversation mode. The method may also include verifying the supply of power to the radio transceiver. The method may also include verifying a communication link between the line interface controller and the radio transceiver at predetermined time intervals. The method may also include switching from the fixed mode to the portable mode if a communication link between the line interface controller and the radio transceiver has been terminated. The method may also include inquiring if the radio transceiver is in a conversation mode or in idle mode. The method may also include charging the radio transceiver when the radio transceiver is in the fixed mode.

BRIEF DESCRIPTION OF THE DRAWINGS

There is illustrated in Figure 1 a block diagram of a fixed cellular terminal system of the present invention with multiple DMTF telecommunication units that may include telephones, facsimile machines and modems.

There is illustrated in Figure 1A a block diagram of an alternative embodiment of the fixed cellular terminal system of the present invention with multiple DMTF telecommunication units that may include telephones, facsimile machines and modems.

There is illustrated in Figure 2 a flow chart of the logic in determining whether to operate the fixed cellular terminal system in a fixed mode through use of the DMTF units, or in a portable mode through use of the radio transceiver as a conventional cellular telephone when the radio transceiver is in an idle mode, wherein it is waiting for a telecommunication.

There is illustrated in Figure 3 a flow chart of the communication sequences between the radio transceiver and the line interface controller of the fixed cellular terminal system to determine if the fixed cellular system should operate in the fixed mode or the portable mode.

There is illustrated in Figure 4 a flow chart of the logic in determining whether to operate the fixed cellular terminal system in a fixed mode through use of the DMTF units, or in a portable mode through use of the radio transceiver as a conventional cellular telephone when the radio transceiver is in a conversation mode, in which a telecommunication is occurring over the cellular network.

There is illustrated in Figure 5 a block diagram of the interface, via a docking mechanism, between the radio transceiver and the line interface system.

DETAILED DESCRIPTION OF THE INVENTION

As shown in Figures 1 and 1A, a fixed cellular terminal system of the present invention is generally designated 20. The system 20 includes a line interface system 22, a radio transceiver 24, a computer 26 and a docking unit 28. A plurality of DTMF telecommunication units 30a-e (modem 30a; telephones 30b-30d; and

Fax 3ae) are connected to the line interface system 22. The line interface system 22 includes a line interface controller 31, a power supply 32 with a backup battery 34, and an indoor antenna 36. The docking unit 28 provides connection between the radio transceiver 24 and the line interface system 22. As shown in Figure 1 A, the docking unit 28a may be an integrated component of the line interface system 22. The radio transceiver 24 may be used as a conventional portable cellular telephone when it is not connected with the docking unit 28, 28a. However, when the radio transceiver 24 is connected to the docking unit 28,28a, the DTMF units 30a-e may use the same telephone number as the radio transceiver 24 through their connection via the line interface system 22. The computer 26 is used to program and reprogram the line interface system 22 and, if necessary, the radio transceiver 24.

The radio transceiver 24 is programmed to recognize when it is being used in a portable mode as a conventional portable cellular telephone, and in a fixed as a component of the line interface system 22. The fixed mode is similar to the fixed mode of the current fixed cellular terminal systems of the prior art where the radio transceiver 24 is physically connected to the line interface system 22. The portable mode is similar to the mobile mode of a conventional portable cellular telephone. The fixed cellular terminal system 20 operates in an idle mode and a conversation mode. The system is in the idle mode when it is waiting for a telecommunication to occur between a user of the fixed cellular terminal system 20 and another party over the cellular network. The system is in the conversation mode when a telecommunication occurs between a user of the fixed cellular terminal system 20 and another party over the cellular network. For example, the telecommunication may be a telephone call, a facsimile transmission, or communication link to the internet. The present invention allows for the radio transceiver 24 to distinguish between the fixed mode and the portable mode, and to switch between the fixed mode and the portable mode even in the middle of a conversation.

As shown in Figure 2, when the radio transceiver 24 is in the idle mode (as compared to the conversation mode), the radio transceiver 24 is programmed to

inquire at predetermined intervals if there has been a change between fixed and portable modes. At block 100, the radio transceiver 24 is activated and automatically goes into the portable mode as its initial mode. Within a predetermined time period (usually 2 seconds), an inquiry is sent from the radio transceiver 24, as shown at block 102, to determine if the radio transceiver 24 is connected to an external power supply and if it is receiving communications from the line interface controller 31 of the line interface system 22. If the response to this inquiry is negative, then the radio transceiver 24 remains in the portable mode. However, if the response to this inquiry is positive, the radio transceiver 24 will switch to the fixed mode, as shown at block 104. At predetermined time intervals when the radio transceiver 24 is in the fixed mode, as shown at block 106,the radio transceiver 24 will send out inquiries as to the status of communications with the line interface controller 31 and as to a connection to the power supply 32 for the line interface system 22. If the inquiries are positive, then the radio transceiver 24 remains in the fixed mode. However, if the inquiry is negative, the radio transceiver 24 switches to the portable mode.

The communication sequences between the radio transceiver 24 and the line interface controller 31 of the line interface system 22 are shown in Figure 3. The format of the communications may be AT commands in ASCII format and/or binary commands. However, those skilled in the pertinent art will recognize that other commands and formats may be utilized in the communications sequences between the radio transceiver 24 and the line interface controller 22 without departing from the spirit and scope of the present invention. As shown in Figure 3, the line interface controller 31 of the line interface system 22 at block 120 is activated and waits for a predetermined time period (usually 2 seconds) before sending off a communication to the radio transceiver 24 which is in the portable mode represented by block 122. A communication 124 from the line interface controller 31 to the radio transceiver 24 inquires whether the radio transceiver 24 is connected to the docking unit 28, 28a. An inquiry, as shown at block 126, as to the availability of external power, is sent out from the radio transceiver 24. A positive response 127 sent to the line interface controller 31 elicits an initialization success reply 128 that initiates the

communication sequences for the radio transceiver 24 to switch to the fixed mode as represented by block 130. At predetermined time intervals, the line interface controller 31 sends status request inquiries 132 to the radio transceiver 24. The radio transceiver 24 will reply with a status response 134 indicating that it is still connected to the docking unit 28, 28a. However, as indicated at block 136, if the predetermined time period expires and a status request is not received by the radio transceiver 24, the radio transceiver 24 changes from the fixed mode into the portable mode. If at a later time a status request 138 is again sent by the line interface controller 31 to the radio transceiver 24, a response 140 will be sent from the radio transceiver 24 indicating that it is again connected to the docking unit 28,28a, and an initialization success 128 communication will be sent from the line interface controller 31 to the radio transceiver 24.

The logic involved in switching between the portable mode and the fixed mode is illustrated in Figure 4. As seen at block 150, the radio transceiver 24 is activated in a default portable mode. An inquiry 152 is sent to determine if there is a connection to an external power supply, and to determine if any communication sequences have been received from the line interface controller 31 of the line interface system 22. A positive response will place the radio transceiver 24 in the fixed mode as indicated at block 154. An inquiry 156 concerning the conversation mode is sent from the radio transceiver 24.

If a positive response is received to this inquiry 156, then as indicated at block 158, the radio transceiver 24 generates a ring via the telephone 30d to indicate that the switching is completed and the conversation can be continued by using the telephone, DTMF unit 30a. A negative response to the conversation mode inquiry 156 will elicit a second response 160 as to the presence of external power and the status of communication sequences from the line interface controller 31 to the radio transceiver 24. A positive response to this inquiry 160 will maintain the radio transceiver 24 in the fixed mode, and after a predetermined time period the conversation mode inquiry 156 will again be sent out by the radio transceiver 24. A negative response to this inquiry 160 will elicit a second conversation mode inquiry

162 from the radio transceiver 24. If the response to this inquiry 162 is positive, then the DTMF unit 30 is not being used and the radio transceiver 24 is being used as a conventional portable cellular telephone. Thus, as indicated at block 164, the software program of the radio transceiver 24 switches the audio path from the DTMF unit 30a to the internal speaker microphone of the radio transceiver 24. However, if the response to this conversation mode inquiry 162 is negative, then the conversation, if any was present, was terminated and the radio transceiver 24 switches to the portable mode.

As shown in Figure 5, the docking unit 28 has an interface 200 for operably connecting the radio transceiver 24. The receptor/interface 200 provides the necessary connections between the docking unit 28 and the radio transceiver 24 for providing connections to the line interface system 22. The docking unit 28 provides a power connection 202 for receiving power from the power supply 32 of the line interface system 22. The docking unit 28 also has a communication interface 204 for providing communications between the radio transceiver 24 and a corresponding communication interface 206 of the line interface controller 31 of the line interface system 22. The docking unit 28 also has an antenna interface 206 for providing access for the radio transceiver 24 to the antenna 36 of the line interface system 22. Those skilled in the art will recognize that other interface connections may be integrated into the docking unit 28 without departing from the spirit and scope of the present invention.

Although the docking unit 28 as shown in Figure 5 is a separate component, the interface units 200, 202, 204, and 206 may be integrated into the line interface system 22. The docking unit 28 may consist of a stand-alone component with connections to the line interface system 22, or it may be integrated into the line interface system 22 as illustrated in Figure 1A.

In using the present invention, only one telephone number need be assigned to the consumer for both the cellular telephone use and also the DTMF use. Thus, a consumer may be reached on his/her cellular phone/radio transceiver 24 or at his/her home at one of the DTMF units such as the telephone 30a through

the use of a single telephone number. The fixed cellular terminal system 20 allows for the radio transceiver battery to be charged while operably connected in the docking unit 28. The radio transceiver 24 may retain all of the functions of a conventional cellular telephone including voice privacy, caller ID, three-way calling, as well as storage of caller ID numbers. Thus, the radio transceiver 24 may be used as an external caller ID display for one of the DTMF units 30a-f. Further, the radio transceiver 24 may be charged during use of the DTMF units 30a-e. Also, billing which is a competitive factor for the operator, may be easily controlled by using the Intelligent Roaming Data-Base (IRDB) data with different SIDs (Residential, Private, Preferred, Favored, etc.). The user may be offered different rate plans depending on the system identifier the phone uses to get service. When the radio transceiver 24 is connected to the line interface system 22, the radio transceiver 24 may automatically be forced to select a special system identification number. Thus, the present invention has the potential to make a fixed cellular terminal system flexible and user friendly.

CLAIMS

I CLAIM AS MY INVENTION:

1. A fixed cellular terminal system for utilization of a DTMF telecommunication unit and a portable cellular telephone in a cellular network, the fixed cellular terminal system comprising:

a line interface system comprising a line interface controller and a power supply, the line interface controller capable of providing a connection between a DTMF telecommunication unit and a cellular network;

a radio transceiver to connect the line interface system to a cellular network and for use as a conventional portable cellular telephone; and

a docking mechanism through which the radio transceiver is connected to the line interface system to connect the line interface controller to the cellular network and to provide power to the radio transceiver from the power supply of the line interface system.

2. The system according to claim 1 wherein the radio transceiver comprises means for detection of a connection from the line interface controller of the line interface system to the radio transceiver.

3. The system according to claim 1 wherein the radio transceiver comprises a software program that is programmed for operating the radio transceiver in a fixed mode for connection of a DTMF telecommunication unit with a cellular network, and for operating the radio transceiver in a portable mode for use as a conventional portable cellular telephone.

4. The system according to claim 1 wherein the radio transceiver comprises means for detection of power being supplied to the radio transceiver by the power supply of the line interface system.

5. The system according to claim 1 wherein the radio transceiver and the line interface controller further comprise means for maintaining a connection to the cellular network during a telecommunication while switching between use of a DTMF telecommunication unit and the radio transceiver as a conventional portable cellular telephone.

6. The system according to claim 1 wherein the DTMF telecommunication unit is selected from the group consisting of telephones, modems, and facsimile machines.

7. A radio transceiver capable of utilization with a fixed cellular terminal system, the radio transceiver operable as a component of a line interface system of the fixed cellular terminal system and also as a stand-alone portable cellular telephone, the radio transceiver comprising:

means for detection of a connection between the radio transceiver and a line interface controller of the line interface system; and

means for operating the radio transceiver in a fixed mode and a portable mode, wherein the radio transceiver is utilized as a component of the line interface system to connect a DMTF telecommunication unit to a cellular network during the fixed mode, and wherein the radio transceiver is utilized as a stand-alone portable cellular telephone during the portable mode.

8. The radio transceiver according to claim 7 further comprising means for detection of power being supplied to the radio transceiver by an external power supply.

9. The radio transceiver according to claim 7 further comprising means for connecting a plurality of DTMF telecommunication units to a cellular network, the plurality of DMTF telecommunication units connected to a line interface system.

10. The radio transceiver according to claim 9 further comprising means for changing the operation of the radio transceiver from the fixed mode to the portable mode while maintaining a connection to the cellular network during a telecommunication, the radio transceiver changing from operation with the DTMF telecommunication unit in the fixed mode to use of the radio transceiver as a conventional cellular telephone in the portable mode.

11. The radio transceiver according to claim 9 further comprising means for changing the operation of the radio transceiver from the portable mode to the fixed mode while maintaining a connection to the cellular network during a telecommunication, the radio transceiver changing from operation as a conventional portable cellular telephone in the portable mode to use of a DTMF telecommunication unit and the radio transceiver in the fixed mode.

12. The radio transceiver according to claim 7 wherein the radio transceiver is a digital cellular telephone or an analog cellular telephone.

13. The radio transceiver according to claim 7 further comprising an internal power supply that may be charged when the radio transceiver is in the fixed mode.

14. A method of using a radio transceiver in a fixed cellular terminal system in a cellular network, said method comprising the steps of:

operating the radio transceiver in one of (a) a fixed mode by interfacing one of the modem, telephone, facsimile through the radio transceiver to the cellular network, and (b) a portable mode as a conventional cellular telephone using the cellular network; and

changing the operation of the radio transceiver to the other of the fixed mode and the portable mode.

15. The method according to claim 14 including the steps of placing the radio transceiver in a conversation mode during a telecommunication over the cellular network, and changing the operation of the radio transceiver to the other of the fixed mode and the portable mode while maintaining the connection to the cellular network by the radio transceiver during the telecommunication.

16. The method according to claim 14 further comprising detecting the supply of power to the radio transceiver.

17. The method according to claim 14 further comprising detecting a communication link between a line interface controller of a line interface system of the fixed cellular terminal system and the radio transceiver at predetermined time intervals.

18. The method according to claim 17 further comprising switching the radio transceiver from the fixed mode to the portable mode if the communication link between the line interface controller and the radio transceiver has been terminated.

19. The method according to claim 14 further comprising inquiring if the radio transceiver is in a conversation mode or an idle mode, wherein the radio transceiver is connected to a cellular network for a telecommunication in the conversation mode, and the radio transceiver is prepared for a telecommunication in the idle mode.

20. The method according to claim 17 further comprising using a DTMF telecommunication unit connected to the line interface system with the radio transceiver in the fixed mode.

21. The method according to claim 14 further comprising charging the radio transceiver with the radio transceiver in the fixed mode.

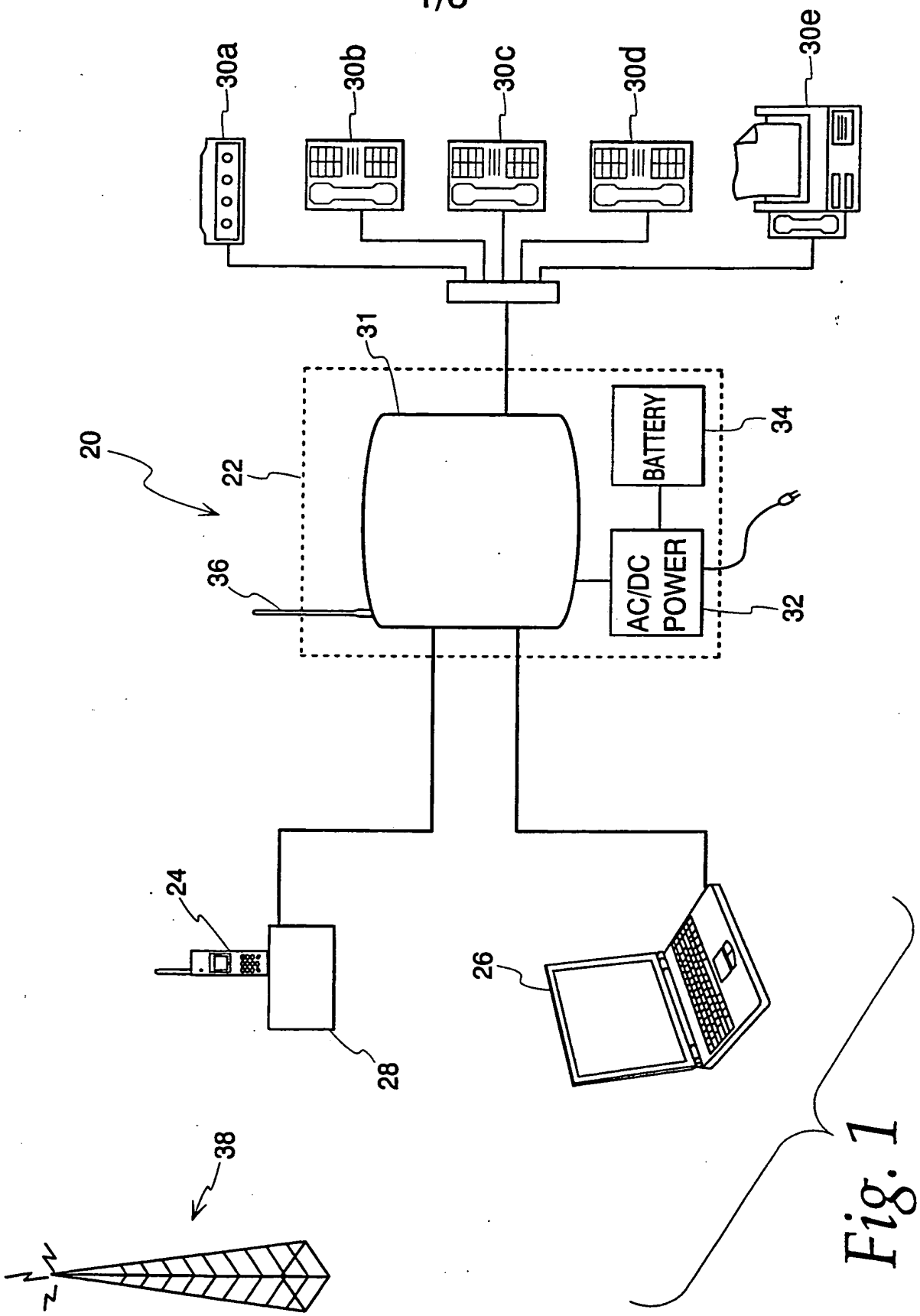
30a
30b
30c
30d
30e
31
20
22
BATTERY
34
36
AC/DC POWER
32
24
26
28
38
N

Fig. 1

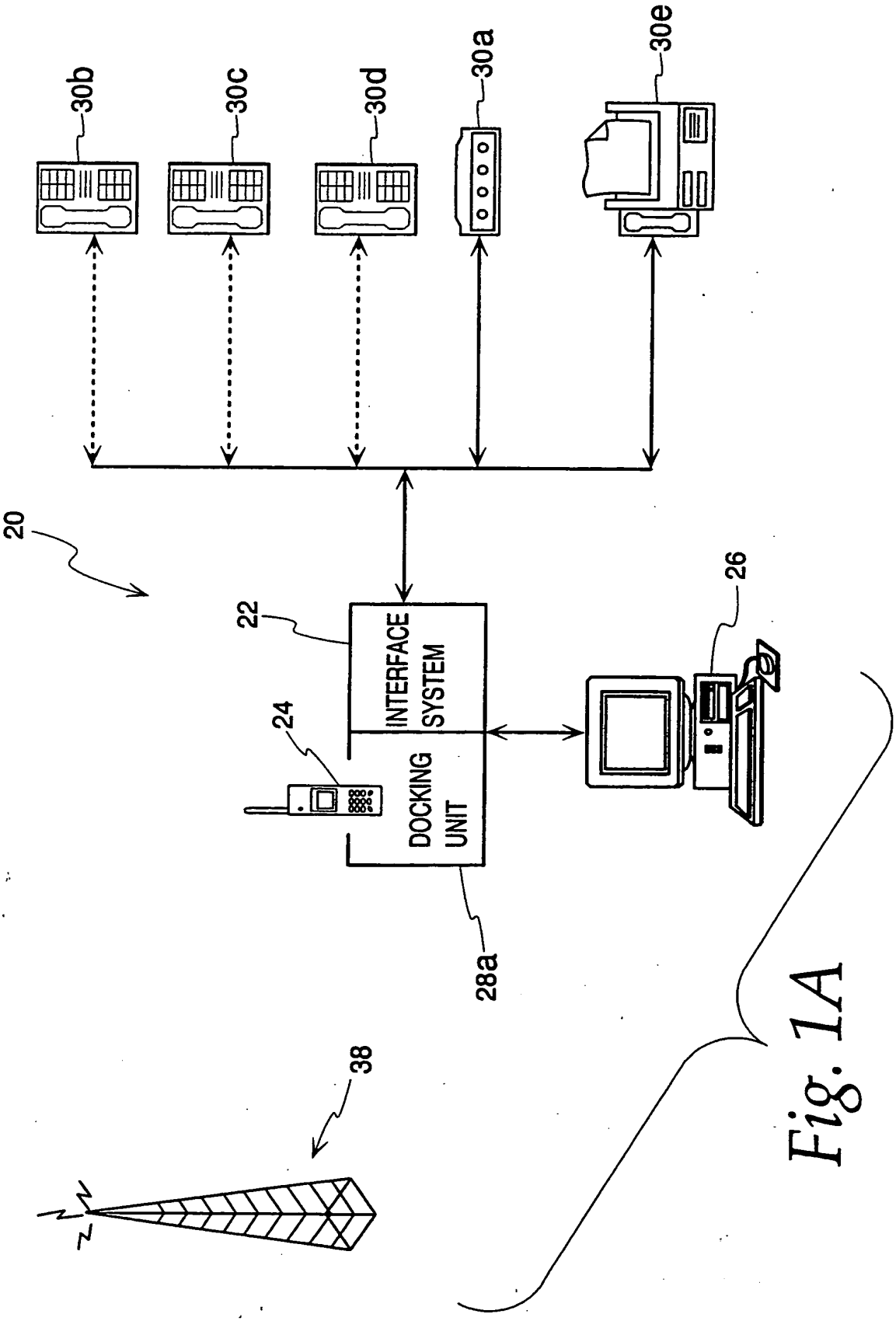
30b
30c
30d
30a
30e
20
22
INTERFACE SYSTEM
24
DOCKING UNIT
26
28a
38

Fig. 1A

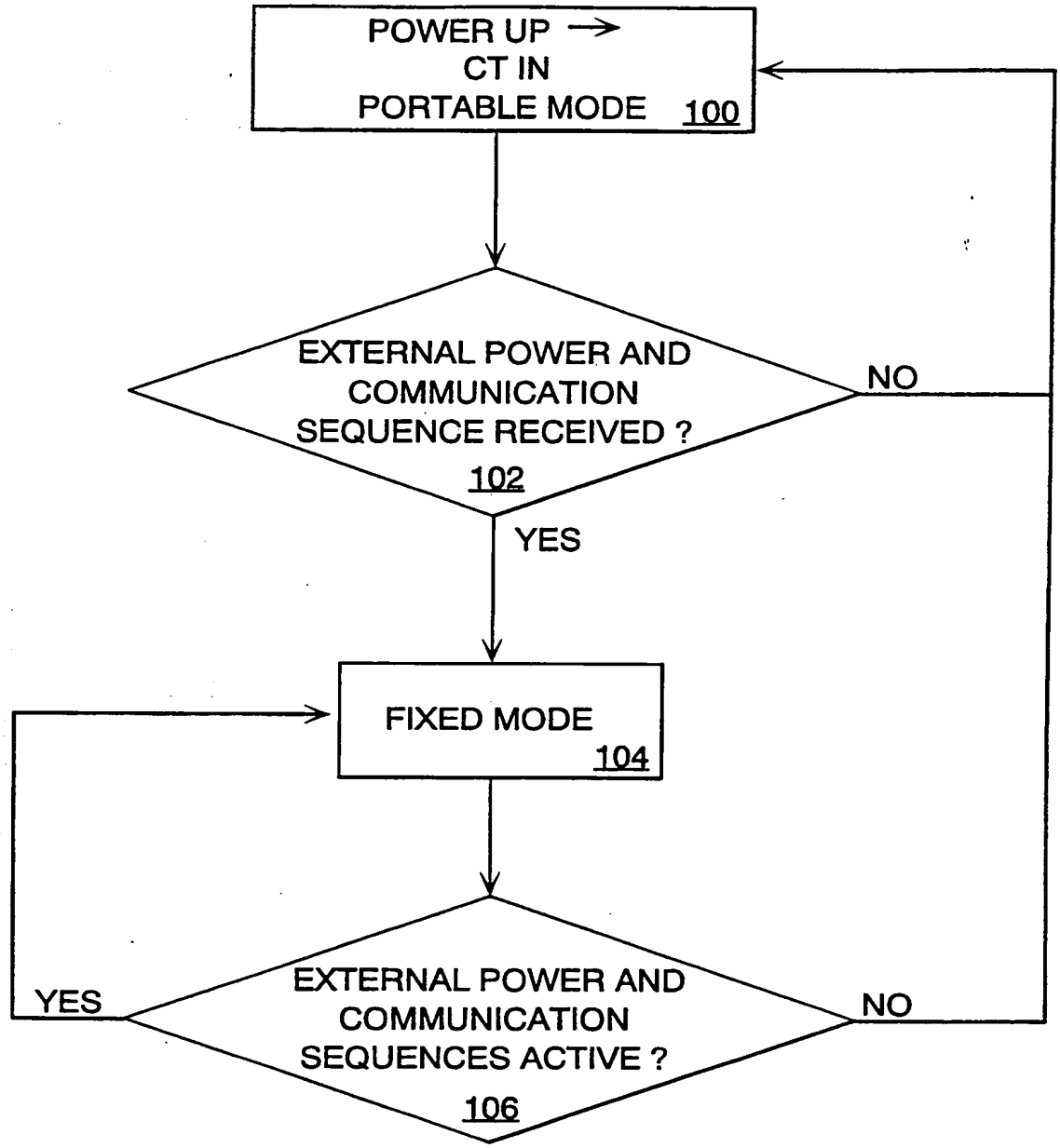
POWER UP → CT IN PORTABLE MODE 100
EXTERNAL POWER AND COMMUNICATION SEQUENCE RECEIVED ? 102
NO
YES
FIXED MODE 104
EXTERNAL POWER AND COMMUNICATION SEQUENCES ACTIVE ? 106
YES
NO

Fig. 2

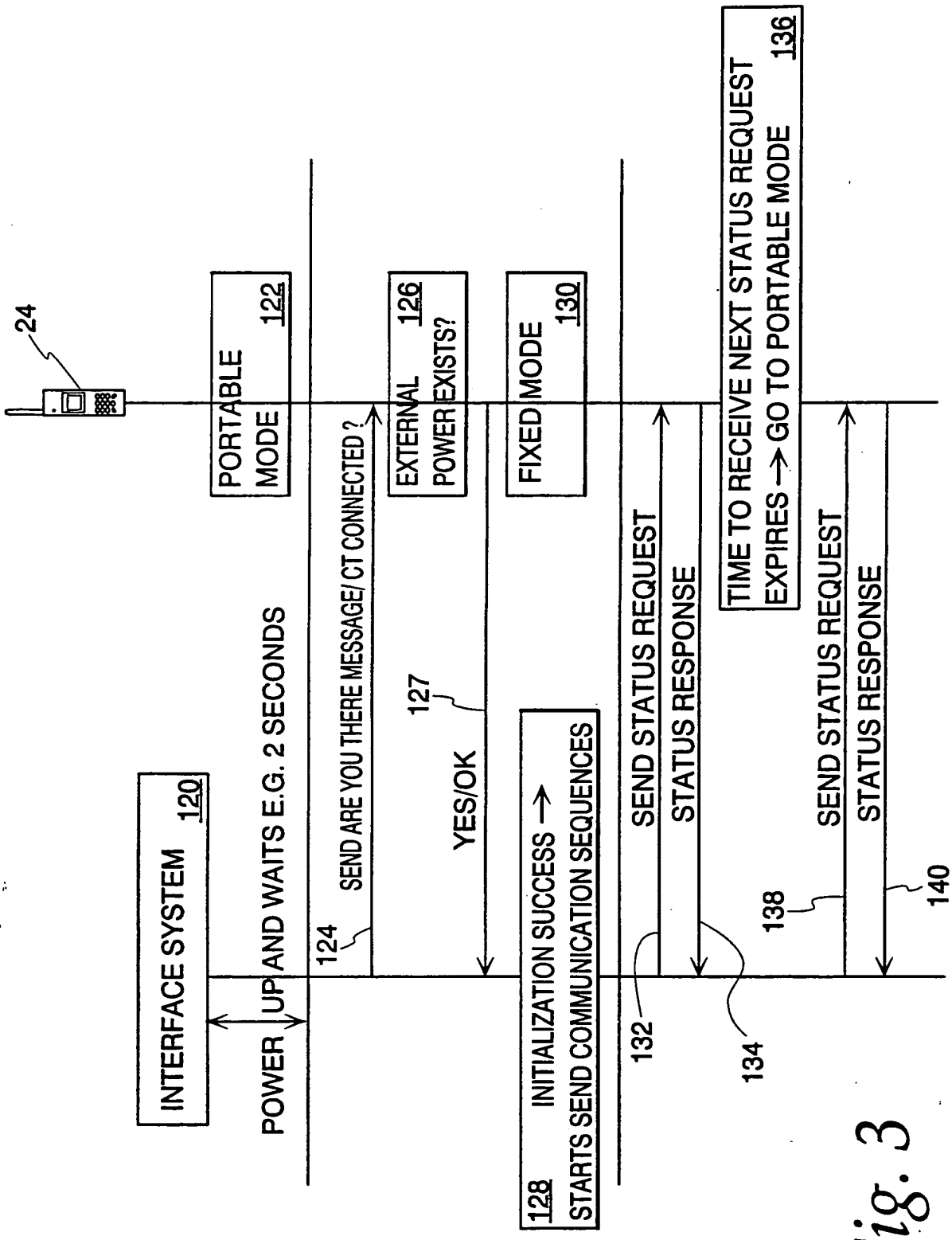
24
INTERFACE SYSTEM 120
POWER UP AND WAITS E.G. 2 SECONDS
PORTABLE MODE 122
124
SEND ARE YOU THERE MESSAGE/ CT CONNECTED ?
EXTERNAL POWER EXISTS? 126
127
YES/OK
FIXED MODE 130
128 INITIALIZATION SUCCESS → STARTS SEND COMMUNICATION SEQUENCES
132
SEND STATUS REQUEST
STATUS RESPONSE
134
TIME TO RECEIVE NEXT STATUS REQUEST EXPIRES → GO TO PORTABLE MODE 136
138
SEND STATUS REQUEST
STATUS RESPONSE
140

Fig. 3

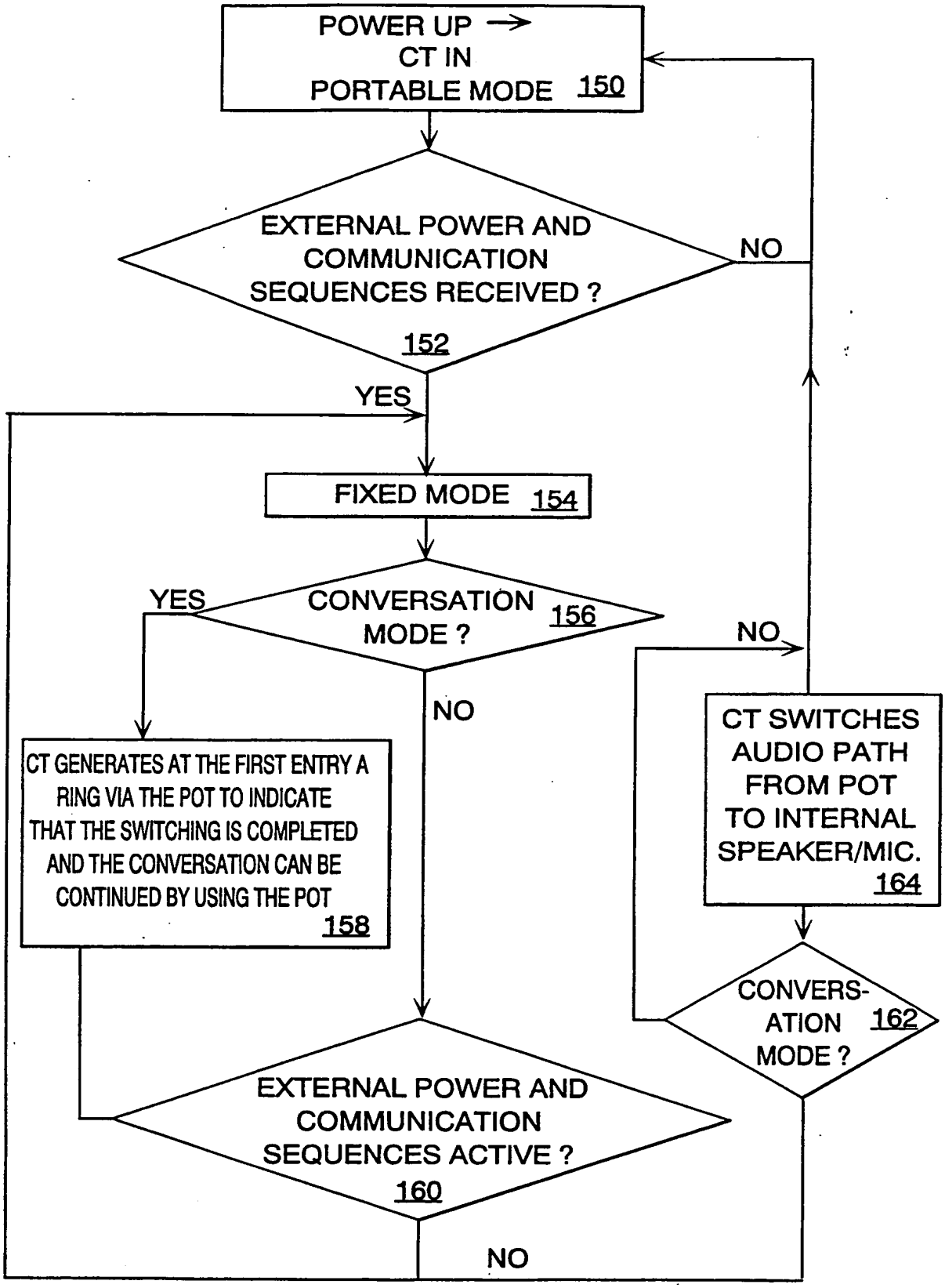
POWER UP → CT IN PORTABLE MODE 150
EXTERNAL POWER AND COMMUNICATION SEQUENCES RECEIVED ? 152
NO
YES
FIXED MODE 154
CONVERSATION MODE ? 156
YES
NO
NO
CT GENERATES AT THE FIRST ENTRY A RING VIA THE POT TO INDICATE THAT THE SWITCHING IS COMPLETED AND THE CONVERSATION CAN BE CONTINUED BY USING THE POT 158
CT SWITCHES AUDIO PATH FROM POT TO INTERNAL SPEAKER/MIC. 164
CONVERS-ATION MODE ? 162
EXTERNAL POWER AND COMMUNICATION SEQUENCES ACTIVE ? 160
NO

Fig. 4

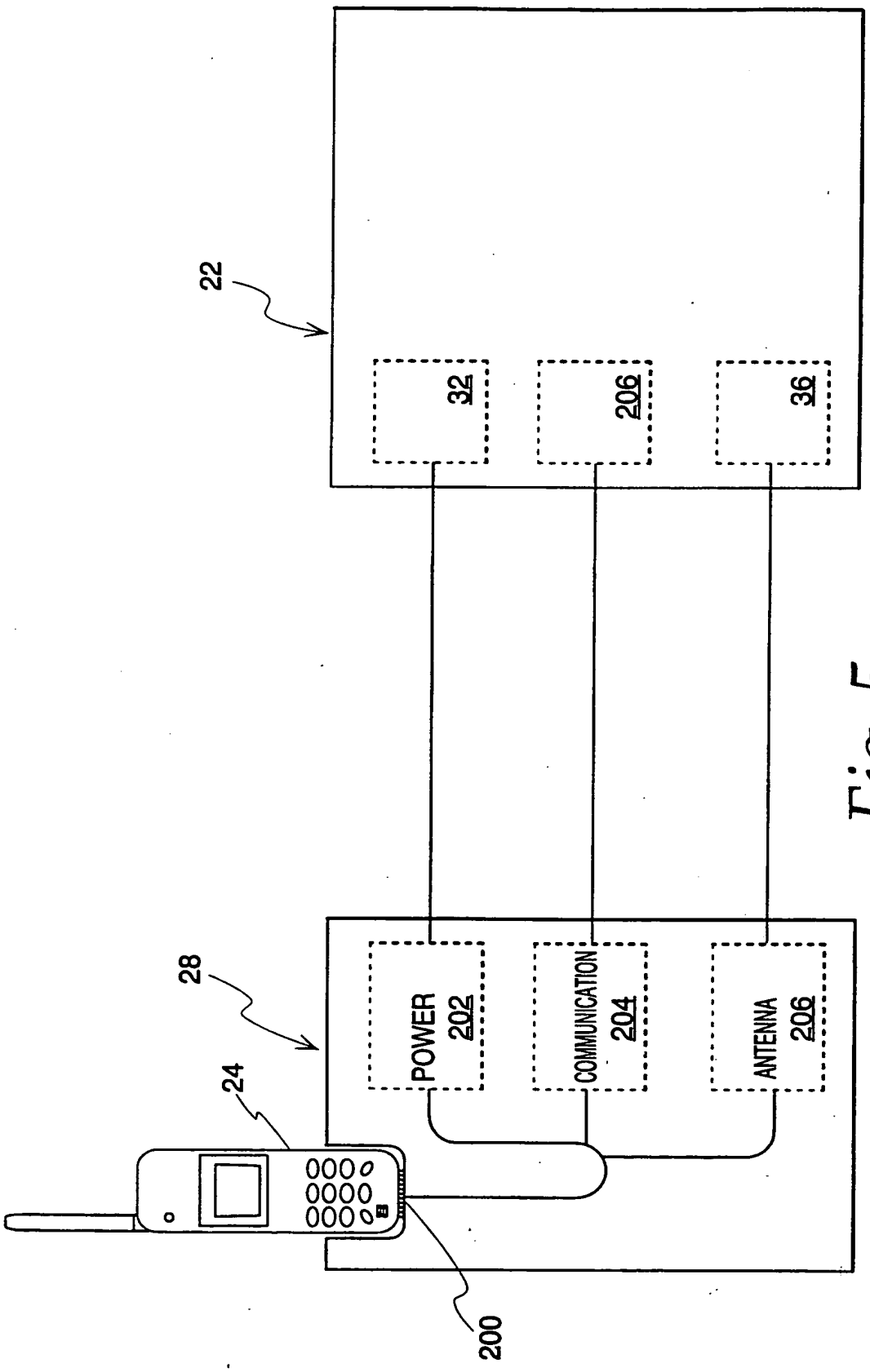
22
32
206
36
28
POWER
202
COMMUNICATION
204
ANTENNA
206
24
200

Fig. 5

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/09019

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q H04M H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 47300 A (CHEW MOH JIN) 22 October 1998 (1998-10-22) page 3, line 18 - line 27 page 4, line 25 - line 31 page 5, line 22 -page 7, line 30 page 9, line 1 - line 3	1-21
X	EP 0 863 648 A (DEUTSCHE TELEPHONWERK KABEL) 9 September 1998 (1998-09-09) column 1, line 51 -column 3, line 27	1-21

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
20 July 2000	27/07/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Heinrich, D

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ional Application No
PCT/US 00/09019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9847300 A	22-10-1998	AU 6936598 A	11-11-1998
EP 0863648 A	09-09-1998	DE 19711056 A	10-09-1998